

## **THE CLAIMS**

### **What is claimed is:**

1. A gas supply and dispensing system, comprising:
  - 5 an array of at least two gas storage and dispensing vessels arranged for sequential on-stream dispensing operation involving switchover from a first vessel to a second vessel in the array;  
  
a pump coupled in gas flow communication with the array for pumping of gas derived from an on-stream one of the vessels in the array, and discharge of pumped gas;  
  
an auto-switchover system constructed and arranged to sense an endpoint limit of the on-stream  
10 one of the vessels and to initiate auto-switching from the on-stream one of the vessels to another of the vessels in the array having gas therein, for subsequent dispensing of gas from said another of the vessels, as a subsequent on-stream vessel,  
  
wherein the auto-switchover system between sensing of the endpoint limit and initiating auto-switching terminates flow of gas to the pump and inactivates the pump; and  
  
15 wherein the auto-switchover system after initiating auto-switching reinitiates flow of gas to the pump and reactivates the pump.
  2. The system of claim 1, wherein the endpoint limit is sensed by the auto-switchover system as an endpoint limit weight of the on-stream one of the vessels.
  3. The system of claim 1, wherein the endpoint limit is sensed by the auto-switchover system as an  
20 endpoint limit pressure of gas dispensed from the on-stream one of the vessels.
  4. The system of claim 1, wherein the endpoint limit is sensed by the auto-switchover system as an endpoint limit flow rate of gas dispensed from the on-stream one of the vessels.
  5. The system of claim 1, wherein the endpoint limit is sensed by the auto-switchover system as an

endpoint limit cumulative volume of gas dispensed from the on-stream one of the vessels.

6. The system of claim 1, wherein the endpoint limit is sensed by the auto-switchover system as an endpoint limit rate of change of a characteristic of gas dispensed from the on-stream one of the vessels.
- 5 7. The system of claim 1, wherein the endpoint limit is sensed by the auto-switchover system as an endpoint limit dispensing time of gas dispensing from the on-stream one of the vessels.
8. The system of claim 1, wherein the auto-switchover system comprises a timer for controllably setting a time interval during which flow of gas to the pump is terminated.
9. The system of claim 1, wherein the auto-switchover system comprises means for dynamically  
10 setting a time interval during which flow of gas to the pump is terminated.
10. The system of claim 9, wherein said means comprise a proportional integrating derivative (PID) control loop.
11. The system of claim 10, wherein said proportional integrating derivative (PID) control loop that  
is operatively coupled with pressure transducer means in flow circuitry coupling the pump in gas  
15 flow communication with the array of gas storage and dispensing vessels.
12. The system of claim 1, wherein the auto-switchover system comprises a timer.
13. The system of claim 1, wherein the auto-switchover system comprises a timer for controllably setting a time interval during which the pump is inactivated.
14. The system of claim 1, wherein the auto-switchover system is constructed and arranged to  
20 terminate flow of gas to the pump prior to inactivating the pump.
15. The system of claim 1, wherein the auto-switchover system is constructed and arranged to reinstitute flow of gas to the pump prior to reactivating the pump.
16. The system of claim 1, wherein the gas storage and dispensing vessels hold a solid-phase physical adsorbent having sorptive affinity for gas stored in and dispensed from the vessels.

17. The system of claim 16, wherein the solid-phase physical adsorbent comprises a material selected from the group consisting of molecular sieves, carbon, silica, alumina, clays and macroporous polymers.
18. The system of claim 16, wherein the solid-phase physical adsorbent comprises carbon.
- 5 19. The system of claim 1, wherein said gas comprises a semiconductor manufacturing gas.
20. The system of claim 1, wherein the gas storage and dispensing vessels comprise interiorly disposed regulators.
21. The system of claim 1, wherein the gas storage and dispensing vessels are disposed in a gas cabinet.
- 10 22. The system of claim 21, wherein the gas storage and dispensing vessels are coupled in gas flow communication to a valved manifold in the gas cabinet.
23. The system of claim 22, wherein the pump is contained in a pumper cabinet.
24. The system of claim 23, wherein the pumper cabinet further contains a surge tank in pumped gas-receiving relationship to the pump.
- 15 25. The system of claim 24, wherein the pump and surge tank are coupled in gas flow communication with a valved manifold in the pumper cabinet.
26. The system of claim 25, wherein the valved manifold in the gas cabinet is coupled in gas flow communication with the valved manifold in the pumper cabinet.
27. The system of claim 26, constructed and arranged to carry out the auto-switchover operational  
20 sequence of FIGS. 24A and 24B.
28. The system of claim 1, wherein gas flow termination to the pump, inactivation of the pump, reinitiation of gas flow to the pump and reactivation of the pump by the auto-switchover system substantially reduces pressure variation of pumped gas discharged from the pump, in relation to a corresponding gas supply and dispensing system wherein the auto-switchover system is not

constructed and arranged for gas flow termination to the pump, inactivation of the pump, reinitiation of gas flow to the pump and reactivation of the pump in connection with the switchover from a first vessel to a second vessel in the array.

5 29. The system of claim 28, wherein the pumped gas discharged from the pump during the switchover from a first vessel to a second vessel in the array is characterized by an absence of pressure spike behavior in the pumped gas.

10 30. A method of substantially reducing pressure variation of pumped gas discharged from a pump in a gas supply and dispensing system comprising an array of at least two gas storage and dispensing vessels arranged for sequential on-stream dispensing operation involving switchover from a first vessel to a second vessel in the array, wherein the pump is coupled in gas flow communication with the array for pumping of gas derived from an on-stream one of the vessels in the array, and discharge of pumped gas,

said method comprising:

15 sensing an endpoint limit of the on-stream one of the vessels and switching from the on-stream one of the vessels to another of the vessels in the array having gas therein, for subsequent dispensing of gas from said another of the vessels, as a subsequent on-stream vessel,

terminating flow of gas to the pump and inactivating the pump, wherein said terminating and inactivating steps are conducted between the step of sensing of the endpoint limit and the switching step; and

20 reinitiating flow of gas to the pump and reactivating the pump, wherein said reinitiating and reactivating steps are conducted after the switching step.

31. The method of claim 30, wherein the endpoint limit is sensed as an endpoint limit weight of the on-stream one of the vessels.

25 32. The method of claim 30, wherein the endpoint limit is sensed as an endpoint limit pressure of gas dispensed from the on-stream one of the vessels.

33. The method of claim 30, wherein the endpoint limit is sensed as an endpoint limit flow rate of gas dispensed from the on-stream one of the vessels.
34. The method of claim 30, wherein the endpoint limit is sensed as an endpoint limit cumulative volume of gas dispensed from the on-stream one of the vessels.
- 5 35. The method of claim 30, wherein the endpoint limit is sensed as an endpoint limit rate of change of a characteristic of gas dispensed from the on-stream one of the vessels.
36. The method of claim 30, wherein the endpoint limit is sensed as an endpoint limit dispensing time of gas dispensing from the on-stream one of the vessels.
- 10 37. The method of claim 30, further comprising controllably setting a time interval during which flow of gas to the pump is terminated.
38. The method of claim 30, further comprising dynamically setting a time interval during which flow of gas to the pump is terminated.
39. The method of claim 38, wherein said dynamically setting step comprises use of a proportional integrating derivative (PID) control loop.
- 15 40. The method of claim 39, wherein said proportional integrating derivative (PID) control loop is operatively coupled with pressure transducer means in flow circuitry coupling the pump in gas flow communication with the array of gas storage and dispensing vessels.
41. The method of claim 30, further comprising controllably setting a time interval during which the pump is inactivated.
- 20 42. The method of claim 41, further comprising use of a timer.
43. The method of claim 30, comprising terminating flow of gas to the pump prior to inactivating the pump.
44. The method of claim 30, comprising reinitiating flow of gas to the pump prior to reactivating the pump.

45. The method of claim 30, wherein the gas storage and dispensing vessels hold a solid-phase physical adsorbent having sorptive affinity for gas stored in and dispensed from the vessels.
46. The method of claim 45, wherein the solid-phase physical adsorbent comprises a material selected from the group consisting of molecular sieves, carbon, silica, alumina, clays and  
5      macroreticulate polymers.
47. The method of claim 45, wherein the solid-phase physical adsorbent comprises carbon.
48. The method of claim 30, wherein said gas comprises a semiconductor manufacturing gas.
49. The method of claim 30, wherein the gas storage and dispensing vessels comprise interiorly disposed regulators.
- 10   50. The method of claim 30, wherein the gas storage and dispensing vessels are disposed in a gas cabinet.
51. The method of claim 50, wherein the gas storage and dispensing vessels are coupled in gas flow communication to a valved manifold in the gas cabinet.
52. The method of claim 51, wherein the pump is contained in a pumper cabinet.
- 15   53. The method of claim 52, wherein the pumper cabinet further contains a surge tank in pumped gas-receiving relationship to the pump.
54. The method of claim 53, wherein the pump and surge tank are coupled in gas flow communication with a valved manifold in the pumper cabinet.
- 20   55. The method of claim 54, wherein the valved manifold in the gas cabinet is coupled in gas flow communication with the valved manifold in the pumper cabinet.
56. The method of claim 55, comprising the auto-switchover operational sequence of FIGS. 24A and 24B.
57. The method of claim 30, wherein gas flow termination to the pump, inactivation of the pump,

reinitiation of gas flow to the pump and reactivation of the pump substantially reduces pressure variation of pumped gas discharged from the pump, in relation to a corresponding vessel switchover not including gas flow termination to the pump, inactivation of the pump, reinitiation of gas flow to the pump and reactivation of the pump in connection with the switchover.

- 5    58. The method of claim 57, wherein the pumped gas discharged from the pump during the switchover from a first vessel to a second vessel in the array is characterized by an absence of pressure spike behavior in the pumped gas.